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**Design of biofuel supply chains with regional depots**

Solving the capacity and inventory planning problem of biofuel supply chain

**The Science**

The production of fuels from lignocellulosic biomass can play an important role in reducing our dependence on fossil fuels while meeting an increasing energy demand. In an effort to meet these goals, regional biomass processing depots have been introduced as a way to improve the biomass supply network.

**The Impact**

The concept of integrated biorefineries emerged as an integration of the several available and biomass-dependent conversion technologies to maximize the economic potential. Technoeconomic assessments of integrated biorefineries based on biochemical, thermochemical, and catalytic platforms have been widely conducted. Approaches for biofuel supply chain design can be grouped into two types: centralized configuration and distributed configuration. In the centralized configuration, biomass is directly transported to the biorefinery and pretreated on site. In the distributed configuration, biomass is densified and/or pretreated to a higher density intermediate at the regional depot for easier transportation and storage.

**Summary**

Researchers in the Great Lakes Bioenergy Research Center have developed optimization models for the design and operational planning of biofuel supply chains including regional depots. The proposed models take into account the variable locations of the regional depots and biorefineries, a feature which has not been previously studied in the literature, as well as biomass selection and allocation, technology selection, inventory and capacity planning at depots and biorefineries, and biomass seasonality. In addition, the amount of biomass feedstock to be converted to fuel is an optimization decision which is subject to availability constraints, and the biomass harvested in one harvesting site can in principle be shipped to different depots or biorefineries if this would lead to better solutions. Since in reality it is not always possible to have the flexibility to determine where and how much biomass to ship, their models can incorporate constraints to identify a near-optimal “steady-state” configuration more aligned with the reality of operating a biofuel supply chain. Specifically, the proposed models can be modified to yield solutions where all biomass from a harvesting site is shipped to a single downstream depot or biorefinery, if the harvesting site is selected; and the intermediate from each depot is shipped to only one biorefinery. The proposed models can aid decision-makers studying the trade-offs in biofuel supply chains, including those between financial and environmental metrics.

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**Publications**

Ng RTL, Maravelias CT. “Design of Cellulosic Ethanol Supply Chains with Regional Depots”. *I&EC Research* 55 (12), 3420-3432 (2016) [DOI: 10.1021/acs.iecr.5b03677]

Ng RTL, Maravelias CT. “Design of Biofuel Supply Chains with Variable Regional Depot and Biorefinery Locations”. *Renewable Energy* 100, 90-102 (2017) [DOI: 10.1016/j.renene.2016.05.009]

**Related Links**

<http://pubs.acs.org/doi/abs/10.1021/acs.iecr.5b03677>

<http://www.sciencedirect.com/science/article/pii/S0960148116304190>

**PM Recommendation for SC Web Publication**

[Yes or No]